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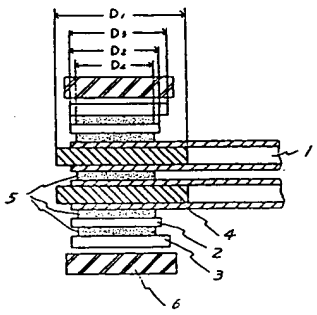
Fluorine resin tube joint - where one end of small dia. fluorine resin tube is inserted into medium and large dia. fluorine resin tube, etc.
C89-152657

A(4-E10, 11-B2E, 11-B8C, 11-C1B, 12-H2)

One end of several pieces of fluorine resin of small dia. and tubular shape is inserted into a medium and large dia. fluorine resin tube. material. At this end part, small dia. tubular material sleeves, small and medium dia. tubular materials, and medium dia. and large dia. tubular materials are connected respectively.

USE/ADVANTAGE - A heat shrinking medium and large dia. tubular material are used. These tubular materials are connected together by the heat shrinking force of the materials themselves and the hot melt characteristics of the fluorine resin powder material. Even in the case of many small dia. tubular materials, they can be connected to each other precisely and easily. (4pp Dwg.No.0/3)



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㊹発明の名称　フッ素樹脂製接合物品およびその製造法

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明　細　書

1.発明の名称

フッ素樹脂製接合物品およびその製造法

2.特許請求の範囲

(1)複数本のフッ素樹脂製小径管状体の少なくとも一方の端部上に、フッ素樹脂製の中径および大径管状体が外挿されており、該端部において小径管状体相互、小径管状体と中径管状体、中径管状体と大径管状体が接合せしめられていることを特徴とするフッ素樹脂製接合物品。

(2)複数本のフッ素樹脂製小径管状体の少なくとも一方の端部上に、熱収縮性を有する中径および大径のフッ素樹脂製管状体を外挿せしめ、前記小径管状体内にはその内径と略同寸法の外径を有する耐熱性芯体を配置せしめ、更にこれら小径管状体の前記端部の外周面に熱融着性を有するフッ素樹脂粉体を配置せしめ、次いで前記中径および大径管状体が熱収縮し且つフッ素樹脂粉体が熱融着し得る温度に加熱することにより、前記端部を接合せしめることを特徴とするフッ素樹脂製接合物品の製造法。

3.発明の詳細な説明

(産業上の利用分野)

本発明は接合部を有するフッ素樹脂製物品の製造法に関するものである。

(従来の技術)

例えば、熱交換器における熱交換エレメントあるいは溶液中の溶存ガスを除去する脱気装置の脱気エレメントには大径管状体と多数の小径管状体を接合せしめた物品が用いられることがある。

そして、このような接合物品の製造法としては、特開昭62−21524号公報に記載された方法が知られている。この方法は、多数の熱可塑性樹脂製チューブを引き揃え、その引き揃えたチューブ束の端部分を同種材料からなるスリーブ内に挿入し、加熱処理ならびにチューブ内外側への圧力差処理により、チューブ同志およびチューブとスリーブとを水密状態に融着する方法であって、前記スリーブとして、チューブ束を囲繞する内周面が加熱処理による内径収縮量を見込んでテーパー状

PTO 00-4159

Japanese Kokai Patent Application
No. Hei 1[1989]-257031

BONDED ARTICLE MADE OF FLUORINE-CONTAINING RESIN AND MANUFACTURING METHOD THEREOF

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BONDED ARTICLE MADE OF FLUORINE-CONTAINING RESIN AND MANUFACTURING METHOD THEREOF

[Futsso jushi sei setsugo butsuhin oyobi sono seizoho]

Inventor: Kenzo Okada

Applicant: Nitto Electric Industrial Co., Ltd.

[There are no amendments to this patent.]

Claims

1. A type of bonded article made of a fluorine-containing resin, characterized by the following facts: for at least one end portion of multiple small-diameter tubular bodies, a medium-diameter tubular body and a large-diameter tubular body are inserted to enclose the small-diameter tubular bodies; in said end portion, said small-diameter tubular bodies are bonded to each other; the small-diameter tubular bodies and the medium-diameter tubular body are

bonded to each other; and the medium-diameter tubular body and the large-diameter tubular body are bonded to each other.

2. A method for manufacturing the bonded article of a fluorine-containing resin, characterized by the following facts: for at least one end portion of multiple small-diameter tubular bodies, a medium-diameter tubular body and a large-diameter tubular body with thermal shrinking property are inserted to enclose the small-diameter tubular bodies; in each of said small-diameter tubular bodies, a heat-resistant core having an outer diameter nearly equal to the inner diameter of the small-diameter tubular body is arranged; a fluorine-containing resin powder having thermal fusing ability is arranged on the outer peripheral surface of said end portion of said small-diameter tubular bodies; then, thermal shrinking is performed for said medium-diameter tubular body and large-diameter tubular body, and the fluorine-containing resin powder is heated to a temperature which allows thermal fusing; in this way, said end portion is bonded.

Detailed explanation of the invention

Industrial application field

This invention pertains to a method for manufacturing an article made of a fluorine-containing resin having a bonding portion.

Prior art

For example, in the heat exchange elements in a heat exchanger and in the degassing elements in a degassing device for removing the gas dissolved in a solution, articles made of a large-diameter tubular body and multiple small-diameter tubular bodies bonded to each other are used.

The method described in Japanese Kokai Patent Application No. Sho 62[1987]-21524 has been used for manufacturing bonded articles. In this method, multiple thermoplastic resin tubes are pulled out and aligned. The end portion of the aligned thermoplastic resin tubes is inserted into a sleeve made of the same type of material. Then, by means of heat treatment or treatment under the pressure difference between the inner and outer sides of the tubes, the tubes are fused to each other, and the tubes are fused to the sleeve in a watertight state. As said sleeve, a sleeve is used having a tapered conical surface portion and an expected inner diameter shrinkage under heat treatment for its inner surface that is arranged surrounding the tube bundle.

Problems to be solved by the invention

In the aforementioned prior art, a sleeve having a conical portion should be used. However, such profiled sleeve cannot be manufactured easily. This is a problem.

In order to solve the problem related to the use of said profiled sleeve, the present patent applicant once proposed a method for forming a bonded article (Japanese Patent Application No. Sho 62[1987]-218200), characterized by the following facts: a large-diameter tubular body made of a thermal shrinking fluorine-containing resin is inserted to enclose small-diameter tubular bodies made of a fluorine-containing resin and, at the same time, a heat-resistant core having an outer diameter nearly equal to the inner diameter of the small-diameter tubular bodies is arranged in each small-diameter tubular body, and a thermal fusable fluorine-containing resin powder is arranged in the portion between the small-diameter tubular bodies and the large-diameter tubular body; then, said large-diameter tubular body is thermally shrinked, and the fluorine-containing resin powder is heated to a temperature that allows thermal fusing, so that the tubular bodies are bonded to each other.

In this method, it is possible to obtain a bonded article made of a fluorine-containing resin easily without using a profiled sleeve.

However, in this method, when the number of the small-diameter tubular bodies is increased, gas bubbles remain in the fused portion made of fluorine-containing resin powder. As a result, there may be problems with respect to the bonding strength and the liquid-tightness.

Consequently, the purpose of this invention is to further improve the aforementioned method by providing a type of bonded article characterized by the fact that it does not make use of a profiled sleeve, and no gas bubbles are formed in the welding portion.

Means to solve the problems

In order to solve the aforementioned problems, the present inventors have performed extensive research. As a result of this research work, although the reason is not yet clarified, it was found that by inserting a medium-diameter tubular body and a large-diameter tubular body in order to enclose the small-diameter tubular bodies, the aforementioned purpose can be realized. In this way, the present invention was reached.

That is, this invention provides a type of bonded article made of a fluorine-containing resin characterized by the following facts: for at least one end portion of the multiple small-diameter tubular bodies, a medium-diameter tubular body and a large-diameter tubular body are inserted to enclose the small-diameter tubular bodies; in said end portion, said small-diameter tubular bodies are bonded to each other; the small-diameter tubular bodies and the medium-diameter tubular body are bonded to each other, and the medium-diameter tubular body and the large-diameter tubular body are bonded to each other.

Also, this invention provides a method for manufacturing the bonded article of a fluorine-containing resin, characterized by the following facts: for at least one end portion of the multiple small-diameter tubular bodies, a medium-diameter tubular body and a large-diameter tubular body with thermal shrinking property are inserted to enclose the small-diameter tubular bodies; in each of said small-diameter tubular bodies, a heat-resistant core having an outer diameter nearly equal to the inner diameter of the small-diameter tubular body is arranged; a fluorine-containing resin powder having thermal fusing ability is arranged on the outer peripheral surface of said end portion of said small-diameter tubular bodies; then, thermal shrinking is performed for said medium-diameter tubular body and large-diameter tubular body, and the fluorine-containing resin powder is heated to a temperature which allows thermal fusing; in this way, said end portion is bonded.

In the following, this invention will be explained in detail with reference to figures. In Figure 1, (1) represents a small-diameter tubular body made of any of the following types of fluorine-containing resins: polytetrafluoroethylene (PTFE), tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA), tetrafluoroethylene-hexafluoropropylene copolymer (FEP), ethylene-tetrafluoroethylene copolymer (ETFE), tetrafluoroethylene-hexafluoropropylene-perfluorovinyl ether copolymer (EPE), etc.

In the example shown in the figure, there are two small-diameter tubular bodies. However, there is no special limitation on the number, and there may be three or more of them. As a matter of fact, this invention is particularly useful for the case when there are many (for example, about 80 or more) small-diameter tubular bodies. In one end portion of said small-diameter tubular bodies (1), medium-diameter tubular body (2) and large-diameter tubular body (3), made of a fluorine-containing resin of the same type or different type as that of said small-diameter tubular bodies (1) (the thermal shrinking rates of the large-diameter tubular body and medium-diameter tubular body are usually in the range of 100-400%), are inserted to enclose the small-diameter tubular bodies.

In each small-diameter tubular body (1), for the end portion corresponding to the insertion of said middle- and large-diameter tubular bodies (2) and (3), is arranged a rod-shaped or cylindrical heat-resistant core (4) having an outer diameter nearly equal to the inner diameter of the small-diameter tubular bodies.

In the later heating operation, when the thermal shrinking force is applied by the middle-and large-diameter tubular bodies (2) and (3) on the small-diameter tubular bodies (1), said core (4) should be able to inhibit deformation of said small-diameter tubular bodies (1). For this purpose, the core should be made of a material that does not deform at the temperature used in the heating operation.

In the heating operation, heat-resistant cores (4) act to maintain the shape of the small-diameter tubular bodies (1). It is preferred that their length (D_1) be larger than the largest length (D_2 or D_3) of insertion of large-diameter tubular body (2) or medium-diameter tubular body (3) into small-diameter tubular body (1). Consequently, a core with a length equal to or larger than that of small-diameter tubular body (1) can be inserted into the body. Said core (3) may be coated with a mold release agent, such as a silicone resin, on its outer peripheral surface for use.

Also, in the method of this invention, while small-diameter tubular bodies (1) are bonded to each other, small-diameter tubular bodies (1) and medium-diameter tubular body (2) are bonded to each other. For this purpose, fluorine-containing resin powder (5) having thermal fusing property is applied on the outer peripheral surface of the end portion of said small-diameter tubular bodies (1). Examples of the fluorine-containing resins that may be used in this case include PFA, FEP, ETFE, EPE, etc. The grain size of the resin is selected corresponding to the type of fluorine-containing resin and the heating temperature, and it is usually about 50 μm or smaller. Length (D_4) of the region of application of said powder is preferably shorter than the insertion lengths (D_2 and D_3) in consideration of the thermal fluidity during heating. If length (D_4) is too large, the fluorine-containing resin, which is thermally fused during heating, flows significantly, so that it flows from the end portion of small-diameter tubular bodies (1) (such as the left end portion shown in the figure) to the interior.

Also, according to this invention, as shown in the figure, it is possible to apply fluorine-containing resin powder (5) on the outer peripheral surface of the end portion of medium-diameter tubular body (2). By means of this arrangement, it is possible to improve the bonding strength between medium-diameter tubular body (2) and large-diameter tubular body (3).

According to this invention, after small-diameter tubular bodies (1), medium-diameter tubular body (2), large-diameter tubular body (3), heat-resistant core (4) and fluorine-containing resin powder (5) are arranged as mentioned previously, the system is heated. For example, heating may be carried out by means of heater (6) arranged on large-diameter tubular body (3). There is no special limitation on the temperature, as long as medium-diameter tubular body (2) and large-diameter tubular body (3) are subjected to thermal shrinking, and fluorine-containing resin powder (5) is subjected to thermal fusing (that is, the temperature should be higher than the softening point, or higher than the melting point).

Due to said heating, thermal shrinking takes place for the heated regions of medium-diameter tubular body (2) and large-diameter tubular body (3). On the other hand, fluorine-containing resin powder (5) softens or melts, displaying its thermal fusing property. Consequently, a thermal shrinking force acts between medium-diameter tubular body (2) and small-diameter tubular bodies (1) and among small-diameter tubular bodies (1), while fusion

bonding by the fluorine-containing resin powder (5) takes place. Also, medium-diameter tubular body (2) and large-diameter tubular body (3) are bonded to each other at the end portion.

In the above, an example of bonding at one end portion of the small-diameter tubular bodies has been shown. However, in this application example, it is also possible to bond at both end portions of the small-diameter tubular bodies, at the same time or one after the other. In the case of bonding at both end portions, it is also possible to use the medium-diameter tubular body and/or large-diameter tubular body having the same length as that of the small-diameter tubular bodies. When the medium-diameter tubular body and large-diameter tubular body with such large lengths are used, it is possible to display a thermal shrinking property over the entire length of the tubular bodies, or only for the end portions where bonding is performed.

Figures 2 and 3 illustrate the structure of the fluorine-containing resin bonded article in this invention. In this structure, multiple small-diameter tubular bodies (1) made of fluorine-containing resin have their two end portions pulled out and aligned. Then, at the two end portions, medium-diameter tubular body (2) and large-diameter tubular body (3) made of fluorine-containing resin and having a length smaller than that of small-diameter tubular bodies (1) are inserted to enclose the small-diameter tubular bodies. Then, at the two end portions, thermal fusing is performed to bond small-diameter tubular bodies (1) to each other, to bond small-diameter tubular body (1) with medium-diameter tubular body (2), and to bond medium-diameter tubular body (2) with large-diameter tubular body (3) by means of fluorine-containing resin (5).

Application Example 1

In the following, this invention will be explained in detail with reference to an application example.

Application example

100 small-diameter tubular bodies made of PTFE and having an inner diameter of 0.5 mm, an outer diameter of 0.8 mm, and a length of 1 m were prepared. At one end portion of said small-diameter tubular bodies, a medium-diameter tubular body made of PTFE and having an inner diameter of 11 mm, an outer diameter of 12 mm, and a length of 3 cm (it has a thermal shrinkage rate of 220%, and a thermal shrinking temperature at 350°C) and a large-diameter tubular body made of PTFE and having an inner diameter of 14 mm, an outer diameter of 16 mm, and a length of 6 cm (it has a thermal shrinkage rate of 160% and a thermal shrinking temperature at 350°C) were inserted to enclose the small-diameter tubular bodies.

Also, inside each of said small-diameter tubular bodies, a rod-shaped iron core measuring 0.48 mm in outer diameter and 10 cm in length was arranged. Also, PFA powder (melting point

305°C) with grain size of about 30 μm was filled between the large-diameter tubular body and the medium-diameter tubular body, between the medium-diameter tubular body and the small-diameter tubular bodies, and among the small-diameter tubular bodies. Also, a heater was arranged on the outer side of the large-diameter tubular body. In addition, the length of the portion where PFA powder was arranged (D_4) is about 5 cm. The configuration of these small-diameter tubular bodies, medium-diameter tubular body, cores, PFA powder, and heater is the same as that in Figure 1.

Then, after the temperature was raised to 380°C over 10 min by heating, the heater and core were removed, and a PTFE bonded article was obtained.

The structure of the bonded article obtained in this case is the same as that shown in Figure 2. In this bonded article, by means of the thermal fusing of the PFA powder, the small-diameter tubular bodies are bonded to each other and to the medium-diameter tubular body, and the medium-diameter tubular body is bonded to the large-diameter tubular body.

The bonding portion of the bonded article was cut, and the fusion portion of PFA powder was visually observed. No gas bubbles were observed.

In another test to determine the gas-tightness of the bonding portion of the bonded article, the opening on one end of the large-diameter tubular body was closed by a stopper, and compressed air at 5 kg/cm^2 was fed in from the opening on the other end, and leakage of the compressed air was visually observed. As a result, no leakage of air was observed. In this case, observation was made as the bonding portion was immersed in water.

Effect of the invention

In the method of the present invention, a medium-diameter tubular body and a large-diameter tubular body having thermal shrinking property are used. Due to the thermal shrinking force and the thermal fusing property of the fluorine-containing resin powder, the tubular bodies are bonded to each other. Consequently, even when there are many small-diameter tubular bodies, it is still possible to perform the bonding operation reliably and easily. Also, for the bonding portion of the bonded article obtained in this invention, as the small-diameter tubular bodies are doubly covered with the medium-diameter tubular body and the large-diameter tubular body, the strength is high, and the durability is good.

Brief description of the figures

Figure 1 is a cross-sectional view of a portion illustrating a manufacturing method of the fluorine-containing resin bonded article pertaining to this invention. Figures 2 and 3 are a front view and side view illustrating an example of the bonded article of this invention.

1 Small-diameter tubular body
2 Medium-diameter tubular body
3 Large-diameter tubular body
4 Heat-resistant core
5 Fluorine-containing resin

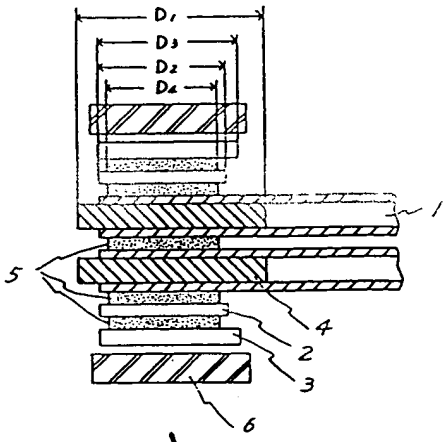

Figure 1

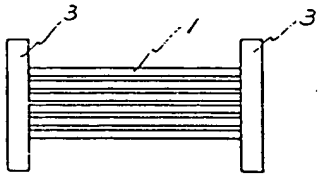

Figure 2

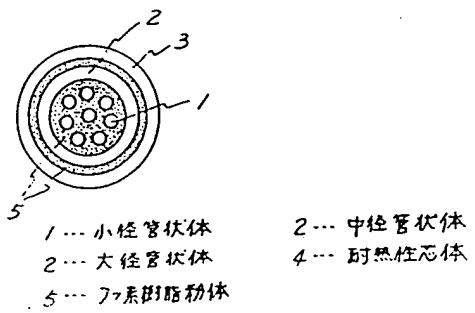

Figure 3

Key:
1 Small-diameter tubular body
2 Medium-diameters tubular body
3 Large-diameter tubular body
4 Heat-resistant core
5 Fluorine-containing resin